INERTIAL CONFINEMENT FUSION
Lawrence Livermore National Laboratory

Monthly Highlights

October 1999

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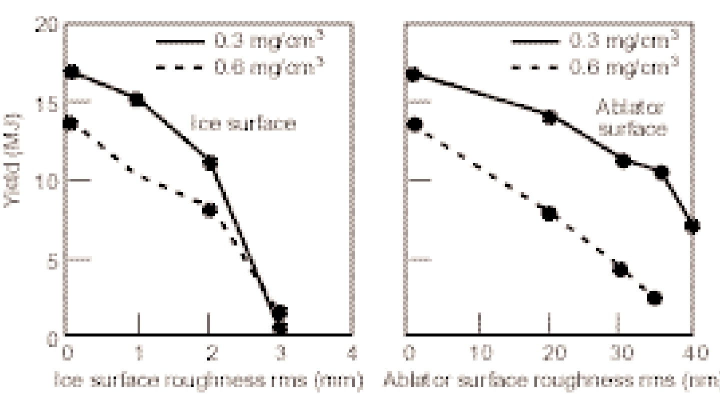
Optics Assembly Building. The National Ignition Facility (NIF) Optics Assembly Building construction has been completed, and commissioning tests are started. The clean-room protocols are well advanced, and the Class 100 area shown here has been completed. The Optics Assembly Building Management Prestart Review process is being initiated to ensure that the physical systems, drawings, procedures, and personnel training are all in place before installation of the assembly and inspection equipment begins. The Management Prestart Review process is a critical step in the Integrated Safety Management work authorization process.

Class 100 clean room in the Optics Assembly Building.

NIF Targets at Higher Cryogenic Temperature. Ignition targets generally perform best at a cryogenic temperature of 18.7 K, which produces a central deuterium-tritium (DT) gas density of 0.3 mg/cm^3. Recent work on cryogenic layer characterization suggests that the layer may be substantially smoother at higher temperatures—close to the triple-point temperature of 19.8 K, where the gas density is 0.6 mg/cm^3. Simulations of Rayleigh–Taylor instability growth on a baseline polyimide target, shown below, indicate that, although performance is reduced and surface roughness specifications are tighter, the target will perform acceptably with plausible surface specifications at the higher temperature.

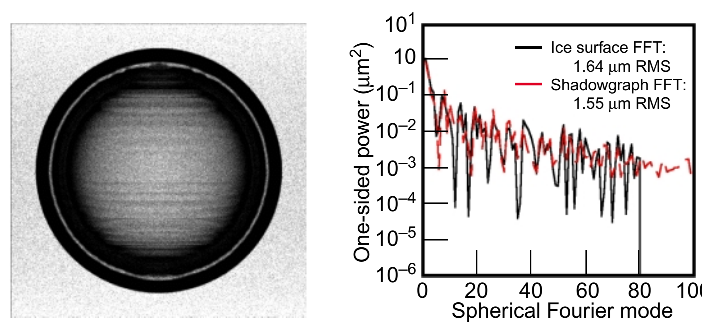


Comparison of NIF target yields for two different initial DT fill densities.

Frontiers in Science Meeting—Episode I. Scientists interested in using the NIF for basic science research met October 4 through 6, 1999, in Pleasanton, California. The meeting, organized by Dr. Richard Petrasso of the Massachusetts Institute of Technology, was attended by 175 scientists from the United States and other countries. The purpose of the meeting was to begin planning the use of the NIF for basic science experiments in the areas of radiation physics, astrophysics, hydrodynamics, material properties, nuclear physics, and inertial fusion energy. A highlight of the program was the keynote address by Dr. Steven Koonin, Vice President and Provost of the California Institute of Technology.

Dr. Steve Koonin delivering the keynote address.

Inertial Confinement Fusion Targets for the NIF. ICF targets will consist of a DT ice layer frozen to the inner surface of a solid shell. Backlit optical shadowgraphy is used to diagnose the smoothness of the ice. With this technique, the capsule is imaged in transmission, and light reflecting off the inner ice surface forms a bright band in the image. A 3D ray tracing code, SHELL3D, has been developed, which simulates this process and determines the accuracy of the shadowgraphy technique. The code generates a shadowgraph from a known ice surface, and the shadowgraph is then analyzed as if it were real data. The code has been used to demonstrate the correspondence between shadowgraph-derived power spectra and actual ice surface power spectra for mode numbers as high as 80, indicating that the diagnostic is sound. Future work will investigate optimum backlighting geometries and optimum bright-band position-fitting algorithms for data analysis.



Simulated shadowgraph *Power spectra comparison*

SHELL3D-simulated capsule shadowgraph (left) and comparison (right) with actual data.

For comments about content of the *Monthly Highlights*, contact Bob Kauffman (925) 422-0419.
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These reports and other LLNL ICF Program information are available on our Web page at http://lasers.llnl.gov/lasers/inertial.html

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